Analysis Ready, Frequent
10 meter Composites
for Global Crop Monitoring

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Operational, Frequent Coverages
• All global croplands
• Analysis Ready time series
• Precisely calibrated
• Live composites updated in NRT
• Best pixel from all observations
Operational Coverages

30m / 16day Version
- 30 meter resolution
- 16 day frequency
- 18 months depth
- Landsat 8 + Landsat 7

10m / 10day Version
- 10 meter resolution
- 10 day frequency
- 18 months depth
- Expanded geography
- Sentinel 2 +Landsat 8
  (+Landsat 7 +ASTER)
• Improve detection / delineation / of individual features
• Improve area measurements
• Improve mapping
• Enhance foundational datasets for regional analysis of area, yield, and production
• Support regional crop monitoring
10m Composite

30m Composite

Field Sizes

Limpopo, S Africa

SWIR1-NIR-R combination
Field Sizes

30m Composite

SWIR1-NIR-R combination

Sao Paulo, Brazil
Field Sizes

10m Composite

30m Composite

Sao Paulo, Brazil

SWIR1-NIR-R combination
### Processing Flow

1. **Discover**
2. **Calibrate**
3. **Bring to common resolution**
4. **Detect Data Gaps**
5. **Composite**
6. **Analyze**

#### BANDWIDTH (nm)

<table>
<thead>
<tr>
<th></th>
<th>Blue Band</th>
<th>Green Band</th>
<th>Red Band</th>
<th>NIR Band</th>
<th>SWIR1 Band</th>
<th>SWIR2 Band</th>
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</thead>
<tbody>
<tr>
<td>Landsat 7</td>
<td>450-520</td>
<td>520-600</td>
<td>630-690</td>
<td>770-900</td>
<td>1,550-1,750</td>
<td>2,090-2,350</td>
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<tr>
<td>Landsat 8</td>
<td>450-515</td>
<td>525-590</td>
<td>630-680</td>
<td>850-880</td>
<td>1,560-1,660</td>
<td>2,110-2,300</td>
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<tr>
<td>Sentinel 2</td>
<td>425-555</td>
<td>525-595</td>
<td>635-695</td>
<td>822-862</td>
<td>1,520-1,700</td>
<td>2,010-2,370</td>
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</table>

#### RESOLUTION (m)

<table>
<thead>
<tr>
<th></th>
<th>Blue Band</th>
<th>Green Band</th>
<th>Red Band</th>
<th>NIR Band</th>
<th>SWIR1 Band</th>
<th>SWIR2 Band</th>
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</thead>
<tbody>
<tr>
<td>Landsat 7</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Landsat 8</td>
<td>30</td>
<td>30</td>
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<td>30</td>
<td>30</td>
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<tr>
<td>Sentinel 2</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>20</td>
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</table>
Sentinel-2 imagery discovery is not straightforward
No source of Sentinel-2 imagery is perfect
Google Sentinel-2 collection has gaps
AWS has no index of Sentinel-2 scenes
GDA Sentinel-2 / Landsat 8 SR Composite (left) draped over NASA’s MODIS SR c6 Imagery (right)
Sharpening

Sentinel-2 source scene at 20m / 10m

GDA Sentinel-2 product at 10 meter

SWIR2-SWIR1-R combination

XinJiang, China
Sharpening

Landsat-8 source scene at 30m

GDA Landsat-8 product at 10 meter

SWIR2-SWIR1-R combination

XinJiang, China
<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>No Data</td>
</tr>
<tr>
<td>1</td>
<td>Clear</td>
</tr>
<tr>
<td>2</td>
<td>Cloud, High Confidence</td>
</tr>
<tr>
<td>3</td>
<td>Cloud, Low Confidence</td>
</tr>
<tr>
<td>4</td>
<td>Cloud Buffer, High Confidence</td>
</tr>
<tr>
<td>5</td>
<td>Cloud Buffer, Low Confidence</td>
</tr>
<tr>
<td>6</td>
<td>Cloud Shadow, High Confidence</td>
</tr>
<tr>
<td>7</td>
<td>Cloud Shadow, Low Confidence</td>
</tr>
<tr>
<td>8</td>
<td>Cloud Shadow Buffer, High Confidence</td>
</tr>
<tr>
<td>9</td>
<td>Cloud Shadow Buffer, Low Confidence</td>
</tr>
</tbody>
</table>
Best Pixel Selection
Sensor & Date Priorities
Real Crop Conditions
Better Data for Crop Monitoring and Analysis
Better Anticipation of Yield and Production

Example: GDA NSW, Australia
Sorghum NDVI
Crop Type NDVIs

Non-GDA ‘Cropland’ NDVI
Data for all crops is combined

GDA Crop Type NDVI
Only data for a given crop type is used

Example: GDA Sorghum NDVIs for NSW, Australia
GDA Monthly Yield Forecasts for USDA IPAD

- Operational since 2010
- ~60 country / crop pairs
- ~350 sub-country / crop pairs
- 16 crop names / practices
- ~2,000 reports / year
On-line, Real-Time Profiling

Spectral profiles for a given date

Time Series profiles for bands & indices
On-line, Real-Time Crop Type Mapping & Acreage Estimation

Example for Mato Grosso, Brazil / Second Corn
THANK YOU
## Composite Sizes

<table>
<thead>
<tr>
<th>Spatial Resolution (m)</th>
<th>30 m</th>
<th>10 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (days)</td>
<td>16 days</td>
<td>10 days</td>
</tr>
<tr>
<td># of revisits / yr</td>
<td>23</td>
<td>37</td>
</tr>
<tr>
<td>composite size*: 1 date (TB)</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>composite size: 1 yr (TB)</td>
<td>52</td>
<td>84</td>
</tr>
</tbody>
</table>

(*) Analysis Ready Data: B-G-R-NIR-SW1-SW2 + on-a-fly NDVI and other indices

Composite is SMALLER than the source imagery as repeat imagery for the same location / date are excluded.
Area Estimation with Imagery: 
(Pentagon as example)

1 m: +0.0% +/-0.2% error (n=11)
15 m: -2.3% +/-1.3% error (n=11)
30 m: +6.1% +/-3.4% error (n=10)

Pentagon Size: 33.8 acres / 137,000 sq m
Source: http://en.wikipedia.org/wiki/The_Pentagon
Operational Coverages

Per pixel date information

Per pixel sensor information

Per pixel quality information